

REMARKS

Claims 6 and 9–15 are pending in this application. By this Amendment, claims 6 and 9 are amended, and claim 15 is added. Non-elected claims 9 and 12–14 are withdrawn from consideration by the Examiner. Support for the amendments to the claims may be found, for example, in the claims as originally filed, and in the specification at page 4, lines 4–14. Support for new claim 15 may be found, for example, in the specification at the paragraph bridging pages 4 and 5. No new matter is added.

In view of the foregoing amendments and following remarks, reconsideration and allowance are respectfully requested.

I. Personal Interview

The courtesies extended to Applicant's representative by Examiners Zimmer and Nguyen at the interview held August 26, 2009 are appreciated. The reasons presented at the interview as warranting favorable action are incorporated into the remarks below, which constitute Applicant's record of the interview.

II. Rejection Under 35 U.S.C. §102/§103

The Office Action rejects claims 6, 10, and 11 under 35 U.S.C. §102(a or e) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over U.S. Patent Application Publication No. 2004/0087440 to Kuno (herein "Kuno"). Applicant respectfully traverses the rejection.

Claim 6 requires that "a molar fraction of cerium and zirconium constituting a ceria-zirconia solid solution in the core part to all the metals in the core part is higher than a molar fraction of the cerium and zirconium constituting a ceria-zirconia solid solution in the surface layer to all the metals in the surface layer" (emphasis added). Despite its asserted teachings, Kuno fails to disclose and would not have rendered obvious at least this feature of claim 6.

The Office Action, on page 2, asserts that Kuno discloses a catalyst comprising a core with a ceria/zirconia solid solution and a surface layer of ceria, citing to Example 2 of Kuno for support. On page 5, the Office Action further asserts that the "core contains ceria as well (present in a solid solution as the particles are fired (calcined), see [0027])." Applicant respectfully disagrees.

One of skill in the art would understand from Applicant's disclosure that the recited ceria-zirconia solid solution is distinct from a core that comprises a mixture of ceria and zirconia phases. Although the term "solid solution" is not expressly defined in the specification, the Bog reference teaches in paragraph [0028], "Solid solution is an art recognized term and includes a homogeneous solid that can exist over a range of component chemicals which are homogeneously mixed with one another on an atomic scale."

The description of the claimed ceria-zirconia solid solution and methods for making it found in Applicant's disclosure is not contrary to Bog's definition. For example, page 4 of the specification describes the following process for obtaining the claimed metal oxide particles:

1. providing a sol containing at least a population of ceria-zirconia solid solution colloid particles and a population of second metal oxide colloid particles (such as a population of ceria colloid particles), differing in the isoelectric point with each other;
2. adjusting the pH of the sol to be closer to the isoelectric point of the population of ceria-zirconia solid solution colloid particles than to the isoelectric point of the population of second metal oxide colloid particles, thereby aggregating the population of ceria-zirconia solid solution colloid particles;
3. adjusting the pH of the sol to be closer to the isoelectric point of the population of second metal oxide colloid particles than to the isoelectric point of the population of ceria-zirconia solid solution colloid particles, thereby aggregating the

population of second metal oxide colloid particles onto the population of aggregated ceria-zirconia solid solution colloid particles; and

4. drying and firing the obtained aggregate.

The disclosure teaches that ceria-zirconia solid solution colloid particles are added to the sol in step 1. The specification further describes on page 10 that a sol containing a population of ceria-zirconia solid solution colloid particles can be obtained by allowing a solution containing a cerium salt and a zirconium salt to undergo hydrolysis or condensation and then aging the solution, wherein the aging is preferably performed at a high temperature under high pressure.

Kuno describes a similar yet different process at paragraph [0021]:

1. preparing a solution comprising zirconia sol and ceria sol,
2. adjusting the pH of the solution within ± 0.5 on the basis of the isoelectric point of zirconia, and aggregating the zirconia, and then
3. aggregating ceria around the aggregated zirconia from the solution to make aggregates.

Both references disclose a process where 1) a solution of a sol of particles A and a sol of particles B is formed; 2) adjusting the pH of the sol to be closer to the isoelectric point of particles A than particles B to aggregate particles A; and then 3) aggregating particles B around aggregated particles A. One difference between the two processes that would be readily apparent to one of skill in the art is that particles A of the Applicant's disclosure are the recited ceria-zirconia solid solution particles, whereas the particles A of Kuno are simply zirconia particles.

Thus, individual primary particles of the core of the claimed catalyst comprise ceria and zirconia (see specification, page 8, lines 27–32: "these primary particles correspond to the colloid particles in the sol"), whereas the individual primary particles of Kuno would consist

of a single compound, such as zirconia. If, as alleged by the Office Action, the core of Kuno also contained a small percentage of ceria, this ceria would be present as primary particles consisting of ceria. Under this alleged scenario, the core of Kuno would comprise mostly zirconia primary particles with a small amount of ceria primary particles. However, the disclosures of Kuno would not result in a zirconia-ceria **solid solution** primary particle.

During the personal interview, Examiner Zimmer countered that Kuno teaches that its particles are calcined, and that calcinating any amount of ceria aggregated with zirconia would result in a ceria-zirconia solid solution.

Applicant respectfully submits that a ceria-zirconia solid solution cannot be obtained merely by aggregating ceria primary particles and zirconia primary particles, and calcinating the obtained aggregates. Instead, such a process generates a secondary particle comprising ceria primary particles and zirconia primary particles.

Attached herewith is a Declaration by Mr. Kuno, the inventor of the Kuno reference applied in this rejection. The Declaration presents evidence showing that the metal oxide particles obtained under the experimental conditions of Example 1 of Kuno has ceria (CeO_2) primary particles and zirconia (ZrO_2) primary particles rather than ceria-zirconia solid solution ($\text{CeO}_2\text{-ZrO}_2$).

Applicant also respectfully submits that if ceria primary particles and zirconia primary particles are calcined under conditions to obtain a ceria-zirconia solid solution, i.e. under conditions where ceria and zirconia primary particles are completely fused, aggregates themselves are also completely fused to become a single bulk. In other words, under conditions where calcination could produce a ceria-zirconia solid solution from aggregate comprising ceria primary particles and zirconia primary particles, "particles" comprising a core part and a surface layer cannot be obtained. Because Kuno teaches particles comprising

a core part and a surface layer, Kuno does not teach calcination conditions that produce a ceria-zirconia solid solution.

Because Kuno does not disclose zirconia-ceria primary particles nor a method of obtaining such particles, Kuno cannot be fairly considered to teach a core containing a ceria-zirconia solid solution. Thus, Kuno does not disclose a core having a molar fraction of a ceria-zirconia solid solution greater than zero. Therefore, Kuno does not disclose a "metal oxide particle comprising a core part and a surface layer, wherein: a molar fraction of cerium and zirconium constituting a ceria-zirconia solid solution in the core part to all the metals in the core part is higher than a molar fraction of the cerium and zirconium constituting a ceria-zirconia solid solution in the surface layer to all the metals in the surface layer" as required by claim 6.

For at least these reasons, Kuno does not anticipate, and would not have rendered obvious claim 6. Claims 10 and 11 depend from claim 6 and, thus, also are not anticipated by and would not have been rendered obvious by Kuno. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

III. Rejection Under 35 U.S.C. §103

The Office Action rejects claims 6, 10, and 11 under 35 U.S.C. §103(a) over U.S. Patent Application Publication No. 2004/0186016 to Bog et al. (herein "Bog"). Applicant respectfully traverses the rejection.

Bog, in paragraph [0031], discloses Ce/M¹ mixed oxide particles that may be coated with an oxide of metal M². In paragraph [0033], Bog discloses that cerium should make up 50 to 99 mol% of the core Ce/M¹ mixed oxide particles. The Office Action cites to paragraph [0070] of Bog that discloses that one or more rare earth metal oxides in an amount of 1 to 60 mol% may be admixed with the oxide of metal M². The Office Action concludes that the disclosure of these ranges could result in a molar ratio of cerium in the coating that is higher

than in the core. The Office Action argues that overlapping ranges are *prima facie* obvious, parenthetically indicating that this is "in regard to the limitation that cerium comprise a higher molar fraction in the surface than in the core."

Contrary to the Office Action's allegations, Bog does not teach, disclose, suggest, or otherwise recognize a relationship between the amount of rare earth metal oxides in the surface layer and the amount of ceria in the core, let alone recognize a relationship between the amount of ceria in the surface layer and the amount of ceria in the core. Bog provides no examples where the molar fraction of rare earth metal oxide present in the surface layer is greater than the molar fraction of ceria present in the core. Bog does not even require a rare earth metal oxide in the surface layer, teaching that it is an optional component. Bog provides no examples of ceria as this rare earth metal oxide.

Because Bog does not acknowledge the parameter in question, it cannot possibly disclose a range for the parameter. Thus, there does not exist an overlap of ranges "in regard to the limitation that cerium comprise a higher molar fraction in the surface than in the core" because Bog simply does not teach or recognize such a parameter. Thus, a rationale based on an overlap of ranges cannot support the rejection.

Instead, Applicant respectfully submits that the analysis should be made under the criteria set forth in MPEP §2144.08, which discusses the obviousness of a species or subgenus where a single reference teaches a genus that encompasses the species or subgenus.¹ However, in this case, considering the claimed invention as a whole, there is no overlap of the

¹ See MPEP §2144.05, which states, " However, if the reference's disclosed range is so broad as to encompass a very large number of possible distinct compositions, this might present a situation analogous to the obviousness of a species when the prior art broadly discloses a genus. *Id.* See also *In re Baird*, 16 F.3d 380, 29 USPQ2d 1550 (Fed. Cir. 1994); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992); MPEP § 2144.08."

genus encompassed by Bog's disclosure and the genus encompassed by Applicant's claims, because Bog does not teach "platinum supported on a metal oxide particle."

Even if this claim limitation is ignored, at best the genus of metal oxide particles encompassed by Bog's disclosure only overlaps slightly with the genus of metal oxide particles encompassed by Applicant's claims. Thus, the claimed genus is not a subgenus of Bog's disclosed genus.

MPEP §2144.08 provides:

In making an obviousness determination, Office personnel should consider the number of variables which must be selected or modified, and the nature and significance of the differences between the prior art and the claimed invention.... Similarly, consider any teaching or suggestion in the reference of a preferred species or subgenus that is significantly different in structure from the claimed species or subgenus. Such a teaching may weigh against selecting the claimed species or subgenus and thus against a determination of obviousness.

To arrive at the metal oxide particles of claim 6, one would need to:

- Select zirconium as M¹. Bog teaches that M¹ is selected from the group consisting of alkaline earth metal, rare earth metal, zirconium, zinc, cobalt copper, and manganese, where calcium, zirconium, magnesium, lanthanum, praseodymium, neodymium, yttrium, cobalt, zinc, copper, manganese, or mixtures thereof are preferred, and the most preferred M¹ metals are calcium and zirconium. *See paragraph [0030].*

- Choose to admix a rare earth metal oxide with the oxide of metal M², and choose ceria as the rare earth metal oxide. Bog teaches that lanthanum oxide is preferred, while providing no example where ceria is selected as the rare earth metal oxide. *See paragraph [0031].*

- Choose to add the ceria in an amount so that "a molar fraction of cerium constituting ceria in the surface layer to all the metals in the surface layer is higher than a molar fraction of the cerium constituting the ceria in the core part to all the metals in the core

part." As discussed above, Bog does not teach this parameter. Bog teaches a range of the rare earth metal oxide of about 1 to about 60 mol% (see paragraph [0070]). Bog provides only two examples (E8 and E9) where this rare earth metal oxide is included with the M² oxide. In both cases, the rare earth metal oxide is lanthana and it is added in an amount of 3 mol% on the basis of the Ce/Zr mixed oxide found in the core, while the M² metal oxide is added in an amount of 40 mol% on the basis of the Ce/Zr mixed oxide found in the core. Thus, the molar fraction of La in the surface layer is only 7% $\left[\frac{(3 \text{ mol \% La})}{(40 \text{ mol \% Al} + 3 \text{ mol \% La})}\right] \times 100$. Examples E8 and E9 disclose that the molar fraction of cerium in the core is 80%. Even if the lanthanum of Examples E8 and E9 is substituted with cerium as proposed by the Office Action, the molar fraction of cerium in the surface layer would only be 7% while the molar fraction of cerium in the core would be 80%. Thus, there are no examples that would have motivated one of skill in the art to choose a high mol% content of ceria in the surface layer.

Furthermore, Bog does not teach or otherwise suggest any benefits of an exhaust gas purifying catalyst comprising platinum supported on a metal oxide particle comprising a core part comprising a ceria-zirconia solid solution and a surface layer specifically comprising ceria. First, Bog does not recognize the problem described in Applicant's specification that when platinum is supported on and is in contact with both ceria and zirconia, the portion of the platinum in contact with the zirconia sinters. *See page 3, lines 7–16.* Second, Bog does not teach the solution to this problem disclosed by the Applicant. Applicant's specification teaches, "OSC can be provided by the ceria-zirconia solid solution in the core part, and when a noble metal, particularly platinum, is supported on this metal oxide particle, sintering of the noble metal can be prevented by virtue of ceria in the surface layer." *See page 4, lines 17–22.*

In summary, there are no teachings present in Bog or any other reasoning proffered by the Office Action that indicate why it would have been obvious to one of skill in the art to

make the selections and modifications of Bog's disclosures to arrive at the claimed subject matter. Indeed, the Office Action fails to follow the examining criteria summarized in MPEP §2144.08(II)(A)(5) (citations omitted):

Based on the evidence as a whole, Office personnel should make express fact-findings relating to the *Graham* factors, focusing primarily on the prior art teachings discussed above. The fact-findings should specifically articulate what teachings or suggestions in the prior art would have motivated one of ordinary skill in the art to select the claimed species or subgenus. Thereafter, it should be determined whether these findings, considered as a whole, support a *prima facie* case that the claimed invention would have been obvious to one of ordinary skill in the relevant art at the time the invention was made.

For at least these reasons, claims 6, 10, and 11 would not have been rendered obvious by Bog. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

IV. New Claim 15

By this Amendment, new claim 15 is added. Claim 15 depends from claim 6 and, thus, distinguishes over the applied references for at least the same reasons that claim 6 does, as discussed above, as well as for the additional limitation recited in claim 15. Examination and allowance of claim 15 are respectfully requested.

V. Rejoinder

Independent claims 6 and 9 have in common the technical feature of a metal oxide particle comprising a core part and a surface layer, wherein "a molar fraction of cerium and zirconium constituting a ceria-zirconia solid solution in the core part to all the metals in the core part is higher than a molar fraction of the cerium and zirconium constituting a ceria-zirconia solid solution in the surface layer to all the metals in the surface layer; and a molar fraction of cerium constituting ceria in the surface layer to all the metals in the surface layer is

higher than a molar fraction of the cerium constituting the ceria in the core part to all the metals in the core part."

For at least the reasons discussed above, the applied references do not teach or suggest at least these features common to independent claims 6 and 9. As such, these features define a contribution over the prior art and, thus, define a special technical feature as set forth in PCT Rule 13.2. Accordingly, Applicant respectfully submits that unity of invention exists between independent claims 6 and 9. As such, rejoinder and favorable consideration of claim 9 and its dependent claims 12–14 are respectfully requested.

VI. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of the application are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,


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Attachments:

Declaration Under 37 C.F.R. 1.132
Petition for Extension of Time
Request for Continued Examination

Date: September 28, 2009

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